

# CHEMICALS

## Project Fact Sheet



## LOW-TEMPERATURE COMPOSITE RECYCLING PROCESS

### BENEFITS

- Recovers marketable carbon fiber
- Increases energy efficiency
- Recycles valuable hydrocarbons
- Reduces consumption of oil as a raw material feedstock
- Reduces landfill use

### APPLICATIONS

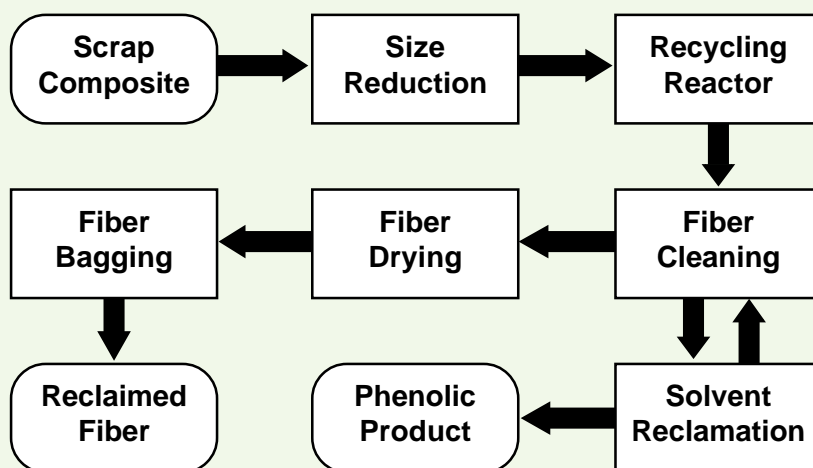
Carbon fiber-reinforced composites are moving into several new, high-volume applications, such as automotive parts. The developed technology will use recovered carbon fibers from these applications, instead of chopped or milled virgin fiber, to formulate composite materials like molding compounds or conductive paper.

## RECYCLING PROCESS FOR CARBON FIBER COMPOSITES PROVIDES ECONOMIC AND ENVIRONMENTAL BENEFITS

Recycling of carbon fiber-reinforced composite plastics into near-virgin fiber and useful hydrocarbons is an economically and environmentally sound practice that is not being fully exploited. Current technology for thermoset composite recycling is either unable to produce fiber with near-virgin quality, is too expensive in capital and operating costs, or is only useful to a limited market. Consequently, conventional recycling of fiber composites consists of grinding up the material for reuse as low-grade filler. The filler material is only of limited use because the reinforcement properties of the fibers are lost and the product has little value. Project partners are developing a low-temperature, low-pressure process that will cost-effectively recover carbon fibers with near-virgin mechanical properties and will allow for conversion of the hydrocarbon thermoset into a marketable product.

The low-temperature, low-pressure approach is based on a new catalytically active reaction mix that can successfully reclaim 95 percent of the carbon-reinforced composite materials used in the market today. Project partners will test the versatility of the process by investigating its applicability to a variety of composite materials. Research results will also establish operational parameters for a commercial recycling plant and its associated economics.

### RECYCLING CARBON FIBER



Carbon fiber-reinforced composite recycling process.



## Project Description

**Goal:** The goal of this project is to develop a low-temperature, low-pressure recycling system for carbon fiber composite materials. The system recovers carbon fiber by utilizing the catalytic degradation of the polymer matrix in a heat transfer fluid.

## Progress and Milestones

Early-stage research showed that most carbon/epoxy composites can be recycled and the fiber reclaimed with fiber purities reaching 98 percent or better. In addition, single fiber breaking strength was found to be within acceptable ranges, with strength losses between 8.5 and 20 percent depending on the investigated material.

Current research is focused on examining the production of phenol formaldehyde resins from recycled composite materials. Project partners will also evaluate the properties of the wood products fabricated using the recycled materials. The following are specific milestones:

- Expose incoming composite feedstocks to different size-reduction operations for information on feedstock preparation
- Determine recycling process parameters
- Use shredded or ground mixtures of epoxy and phenolic-based resins to examine any problems that may occur with mixed resins
- Evaluate the liquid phenolic material recovered from the original wet chemical recycling process as a raw material in phenolic resin production
- Evaluate the quality of the fibers produced
- Design a commercial unit and perform detailed economic analysis

## Commercialization

Adherent Technologies, Inc. will market the developed technology in the United States, Europe, and Asia. The National Renewable Energy Laboratory (NREL) is participating in commercialization decision-making by using their extensive experience to perform an economic analysis of the technology to establish the costs of extraction.



### PROJECT PARTNERS

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